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(54) MOBILE RADIO HANDOVER INITIATION DETERMINATION

FUNKGERÄT MIT BESTIMMUNG DER EINLEITUNG DES WEITERREICHENS

DETERMINATION DU DEMARRAGE DE COMMUTATION DANS UN RADIOTELEPHONE MOBILE

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Description

This invention relates to handover determination between cells in a cellular radio system handling communications to and from a mobile unit.

It is important that handover between cells in a cellular radio network is conducted appropriately and reliably. In mixed cell environments comprising macrocells and overlying microcells, the usability of an established communication channel with a base station could be both noise and interference limited. As far as maintaining of signal quality and the limitation of the effects of interference are concerned, it is possible to use dynamic channel assignment in all cells. However, to afford an appropriate level of reliability for a mobile unit on the move it is necessary to be able to perform intercell handover both reliably and at the appropriate time.

Handover decisions are conventionally performed by monitoring a property such as signal strength or bit error rate (BER) indicative of the quality of the radio link between the mobile unit and the serving base station, and arranging for a handover when this quality falls below a threshold value. The threshold value may be determined from the signal quality of other nearby base stations, such that if a base station other than the current serving base station can provide a radio link to the mobile unit with a better signal quality, the call is handed over to that unit. Examples of such systems are disclosed in United States Patent 4829519 (Scotton) and European Patent Specifications 0241954 (Philips), 0236194 (Societe d'Etudes et de Constructions Electroniques), and 0037070 (Siemens).

In a cellular radio system comprising both macrocells and overlying smaller microcells, a call to or from a mobile unit within the operating area of the system is handled by a base station for each cell. Whereas, a macrocell may be of a size covering a number of streets and extending for 1 or 2 kilometres in all directions, a microcell will often be about 200 to 500 metres long and may only extend linearly along a street, within the coverage area of a macrocell.

The handover between a microcell and a macrocell is subject to special considerations. It is important for the system to be able to determine whether it is worthwhile effecting a handover of a mobile unit from a macrocell to a microcell as the latter is approached or between adjacent microcells. It may be that the mobile unit is going to enter the candidate microcell for a significant period, in which case a handover is beneficial, or relatively momentarily as the candidate microcell is crossed.

According to the present invention there is provided a handover determination system for a mobile radio network comprising a plurality of cells, each having associated with it a base station for supporting communications with a mobile unit, the system comprising:

means for monitoring a quality of a signal respectively transmitted between each of a plurality of candidate base stations and the mobile unit;
means for producing an indication of the rise or fall in the said quality; and
control means for initiating a handover from a serving base station, supporting communications with the mobile unit, --o another base station, the initiation being based on the rise/fall in the said quality of the signals associated with the plurality of candidate base stations being monitored.

By monitoring the rate of rise or fall of signal quality associated with candidate base stations, inappropriate handovers can be avoided.

Preferably, the mobile unit comprises the monitoring means and the producing means, the mobile unit further comprising signalling means for addressing the serving base station with an indication of the need for a handover to be initiated. The signalling means may be arranged to address the serving base station with an indication of the level of priority of a handover and/or with an indication of the possibility of a handover continaent upon the preceeding results of monitoring the quality of the transmitted signal. Advantageously, the monitored signal is transmitted from each mobile unit to the base station.

The monitored signal may be the received signal power. However, in digital communications systems the bit error ratio can be used.

Preferably, the control means are arranged to instruct the monitoring means to monitor a set of signals, each signal being distinctive of one of the corresponding set of base stations, the composition of the set being defined in accordance with the identity of the serving base station. In particular, each signal in the set of signals may distinguish a respective base station by the frequency of the signal.

In one particular form of the invention, the indication producing means include a quality decrement/increment esrimator which is arranged to determine the rise or fall in the quality from the calculation of the running average of the indications. There may also be provided means for storing templates of changes in signal quality and/or rates of change thereof, the control means are arranged to initiate a handover based at least partially on the recognition of a substantial match between the incoming signal and a template.

The invention also extends to a handover determination method for a mobile radio network comprising a plurality of cells, each having associated with it a base station for supporting communications with a mobile unit, the method comprising:

monitoring a quality of a signal respectively transmitted between each of a plurality of candidate base stations and the mobile unit; and initiating a handover from a serving base station, supporting communication with the mobile unit, to another base station, characterised in that an indication of the rate

of rise or fall in the said quality is produced; and the handover initiation is based on the indications of the rates of rise/fall in the said quality of the signals associated with the plurality of candidate base stations being monitored.

Furthermore, the invention also exetends to a mobile unit for a mobile radio system, the mobile unit comprising means for receiving a plurality of signals each respectively transmitted by one of a set of candidate base stations; means for monitoring the quality of the signal; and signalling means for transmitting to a serving base station, supporting communication with the mobile unit, a signal indicating the need for a handover to a candidate base station characterised in that the mobile unit includes means for producing an indication of the rise or fall in the said quality; of the signals associated with the plurality of candidate base stations being monitored.

The rise or tall in the quality being monitored may be interpreted to derive an indication of the need for a handover based on the likelihood of the serving base station and each of the candidate base stations being able to support communication, preferably for a substantial duration which would make handover worthwhile.

The invention can be put into practice in various ways, one of which will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a block diagram of an intelligent mobile unit for use in the invention; and
Figure 2 is a block diagram of a speed estimator for use in the invention.

The embodiment of the invention includes an intelligent mobile unit which is able to monitor intensively the strength of signals transmitted from adjacent microcell base stations in addition to a serving microcell or macrocell base station.

If the serving cell is a microcell which has a boundary in common with a parent macrocell, the adjacent macrocell base station is also monitored by the mobile unit.

The invention utilises an assessment of the variation in signal quality, e.g. received power level or bit error ratio, of a signal transmitted between each target microcell and possibly an adjacent macrocell, which are candidates for a handover, and the mobile unit which is served by a currently serving microcell or macrocell.

Referring to Figure 1 the intelligent mobile unit is used to monitor the signals received from the serving and target base stations as well as to transmit handover initiation commands.

The transmitted signals are relayed from a transmitter (the base station) to the receiver (mobile unit) radio frequency front end 50 to be processed by a pair of receiving circuits.

On the one hand, the received signal is passed from the radio frequency, front-end 50 to a receiver unit 52 arranged to derive the control channel information from the incoming signal transmitted from the serving base station. The basic information is then applied to a control channel information processor 54. The processor 54 demodulates and decodes the control channel information for use by a central processing unit 56. The processed information is then used by the central processing unit 56 in the handover determination. This is described below.

On the other hand, the received signal from each of the serving and target base stations is also relayed from the radio frequency front end 50 to a signal measurement unit 58 which provides a measurement of signal quality. The unit 58 may be, for example, a received signal strength indication or bit error rate counter.

A running average is then determined of the indication or count by a running averager 60. The averaging serves to smooth out transients. A determination of the trend in the signal quality is then derived by an increment/decrement estimator 62 from the averaged signal. The averaged signal is also used by a speed estimator 54 to provide an estimation of the absolute speed of the mobile unit.

The information from the control channel information processor, the increment/decrement estimator and the speed estimator is sent to the central processing unit 56. The central processing unit uses the control channel information downloaded from the serving base station to determine the monitoring algorithm to be adopted according to the type and location of the cells in and around which the mobile unit is located.

The trend in signal quality, the speed estimation, a look-up table 68 of signal quality templates and the control channel information downloaded from the base station, are used to determine whether a handover is appropriate and, if so, whether it should be on an intracell or an intercell basis.

The central processing unit 56 controls a frequency synthesiser 70 associated with the radio frequency front end to scan the channel set of frequencies used by the serving and target base stations in order to perform signal level measurements, and to control the transmission and reception of signals.

The processing unit also controls the operation of a transmitter 72 arranged to transmit handover initiation information via the radio frequency front end 50, to the serving base station.

Each base station in a cellular radio system according to the invention transmits a signal identifying the base station specifically. Each time the mobile unit is handed over from, say, a macrocell to a microcell or between microcells, a new set of carrier frequencies to be monitored and a new algorithm for addressing adjacent candidate base stations, in order that their signal levels can be monitored is downloaded from the newly appointed serving base station. Each algorithm sets out

the frequencies to be monitored and the look-up table of signal level increment/decrement gradient templates. Each template is associated with a mobile unit moving at a particular speed towards or away from the various monitored base stations.

As will be shown below, in many cases the detection of a rise or fall in signal power level received from a particular base station is sufficient on which to base a handover decision in conjunction with the conventional criteria determining handover, i.e. signal level thresholds and hysteresis, the latter causing a delay after the threshold is passed to ensure that the change in signal level is not simply a momentary phenomenon. However, there are also situations in which it is necessary to know the rate of change of signal levels in relation to the speed of the mobile unit in order to determine whether a handover is appropriate or not.

In our co-penaing British Patent Application No. 9016341.1 filed on 25th July 1990, there is described a speed estimator which can be adapted to provide an assessment of the speed of a mobile unit in a cellular radio system based on filtered received signals. As also described in that application, the speed estimator can be adapted to provide an increment/decrement indication from the running average of vehicle speed.

Such a speed estimator is shown in Figure 2. It consists of a received signal strength indicator circuit 10 which outputs a voltage level signal proportional to the received signal power to an analogue-to-digital convertor 12 (ADC). The sampling rate of the ADC 12 is determined by the averaging window duration to the highest required speed. The highest speed to be determined is 40 m/s and as 100 samples are required to determine a running average, a sampling rate of 1.7kHz is required (i.e. 100 samples per 60 ms). A rounded sampling rate of 2kHz may be applied.

In Figure 2, the digital data from the ADC 12 is fed in parallel to a number of speed detection modules comprising averaging units 14 to 20 each with an averaging window of a different duration (1, n1, n2, n3, etc.). The output from each of the averaging windows is input via an average-buffer 26 into a variance calculator 28 before being fed to speed decision logic 30.

The averaging unit 14 with a window of 1 sample is equivalent to the instantaneous signal level. A running average can be calculated at each clock cycle where a new sample value is fed in parallel to all the averaging units 14 to 22. The estimator will not be operational until all the averaging units and the buffers 26 are filled with samples. Thus, the time delay for the system to be operational is equivalent to the size of the largest averaging window (n3) plus the average-buffer-size. The size of the buffer 26 is usually small, eg 10 samples. Thus, the majority of the time delay is taken up with filling the largest averaging unit n3. For instance, if the largest averaging unit n3 is for averaging over 3 seconds, then the system will have a time delay of approximately 3 seconds plus a short time to load the buffer 26.

This speed estimator can be implemented in hardware and/or software and the number of speeds can be estimated by implementing a multiple number of basic speed detection modules.

The increment/decrement heading estimator is an extension of the speed estimator. The values stored in the average-buffers could be easily manipulated by software to return either a majority logic vote for the underlying trend or the slope of the running average.

The mobile unit is able to base a handover decision on an assessment of mobile unit received signal power level indications from 2 or more adjacent candidate base stations. Alternatively, the mobile unit may be arranged to alert the current serving base station of the desirability of a handover. It will be appreciated by the skilled person that any suitable assessment of signal quality could be used in place of or in combination with received signal levels. As one example, the bit error ratio could be used when a digital information signal is transmitted by the base stations. As another example signal delay testing (timing advance) can be used to determine the distance of the mobile unit from a base station. Whatever assessment is adopted, the result is used in a determination of the mobile unit heading relative to each of the candidate base stations.

When the mobile unit is monitoring signals transmitted from candidate base stations, various scenarios for a given serving base station will be used to determine the appropriateness of handover. These scenarios will form a set of condition templates, the constituents of which will be specific to a particular serving base station. However, there are various predictable scenarios which can be defined in general terms :

1. If a mobile unit is served by a microcell and the signal levels from both the serving microcell base station and candidate microcell base station are decreasing as indicated by the increment/decrement estimator this implies that the mobile unit is leaving the serving microcell via a side road and handover from the serving microcell to the parent macrocell should be initiated straight away.

2. By contrast, if a mobile unit is served by the macrocell and the mobile unit detects the signal levels from 2 adjacent microcell base stations (established, for example, in line along the same street) are increasing simultaneously, this indicates that the mobile unit is approaching an area served by microcells. In this situation a handover operation may potentially be required. However, only a standby flag is set to warn the system including the current serving and the target base stations or to raise the priority of access for the mobile unit to the microcell system. No handover execution is effected until further information is obtained.

3. After the above warning flag has been set, if the

signal levels monitored by the mobile unit change from both increasing to one increasing while the other is decreasing at a pre-defined rate, this implies that the mobile unit is within the service area of one of the microcells. Handover from the serving macrocell to the microcell in which the mobile unit is adjudged to be, i.e. as identified by the increasing signal level, should be executed immediately. The success of the handover will only depend on the availability of a channel in the microcell base station.

4. When a mobile unit is travelling within the area served by the microcell, the previous scenario also serves as a confirmation that the mobile unit remains within it and that the handover to the microcell was appropriate.

5. If when the mobile unit is served by the microcell, it fails to locate another microcell base station with increasing signal levels, then a handover to a macrocell must be initiated. This will occur when a mobile unit has entered the outer cell of a microcell sub-network and is about to exit from it. The outer cell is typically constituted by the last microcell in a street.

6. However, when the mobile unit is in a macrocell and the signal level from microcell base station is on the increase, this indicates that the mobile unit is approaching that microcell. In this situation a handover from the macrocell to the candidate microcell snould be initiated. It must be noted that in this situation the rate of increase in relation to the vehicle speed must also be assessed. This is to distinguish proper entry into a microcell from a situation where the mobile unit is merely crossing the candidate microcell. If the rate of increase detected is steeper than the limit represented by normal approach, a delay factor should be built-in before initiating the handover. This will allow handover only if the signal level continues to increase during the delay, indicating that the mobile unit has turned into the microcell rather than subsequently crossed it.

7. For a 3 microcell merging situation if the signal levels of 2 microcell base stations are decreasing and the third one if increasing, this implies that the mobile unit is leaving the microcell sub-network extending along one road and is likely to join the microcell sub-network extending along a brancning or parallel road.

The implementation of the proposed handover processing techniques requires an intelligent mobile radio receiver which has the capabilities of processing running averages and of monitoring the signal level variations. In addition it must also be able to store all the pre-defined handover condition templates and the information downloaded from a base station after handover has been effected, and the information containing instructions on the monitoring carrier frequencies for adjacent candidate base stations which are to be monitored while the mobile unit is in that serving cell.

Claims

1. A handover determination system for a mobile radio network comprising a plurality of cells, each having associated with it a base station for supporting communications with a mobile unit, the system comprising:

   monitoring means (14,16,18,20) for monitoring a quality of the signals respectively transmitted between each of a plurality of candidate base stations and the mobile unit;
   control means (56) for initiating a handover from a serving base station supporting communications with the mobile unit, to another base station,
   characterised in that the system comprises indication means (30) for producing an indication of the rate of rise or fall in the quality monitored by the monitoring means (14, 16, 18, 20); and the control means (56) is arranged to initiate handover in response to the indications produced by said indication means (30), the indication being based on the rates of rise/fall in the said quality of the signals associated with the plurality of candidate base stations being monitored.

2. A system as claimed in claim 1, in which the mobile unit comprises the monitoring means (14, 16, 18 20) and the indication means (30), the mobile unit further comprising signalling means (50) for addressing the serving base station with an indication of the need for a handover to be initiated.

3. A system as claimed in claim 2, in which the signalling means (50) are arranged to address the serving base station with an indication of the level of priority of a handover and/or with an indication of the possibility of a handover contingent upon the preceding results of monitoring the quality of the transmitted signal.

4. A system as claimed in any of claims 1 to 3, in which the signalling means (50) transmits the monitored quality of the signal from each mobile unit to the serving base station.

5. A system as claimed in any of claims 1 to 4, in which the monitoring means (14, 16, 18, 20) monitor the

received signal power or the bit error ratio.

6. A system as claimed in any of claims 1 to 5, in which the control means (56) are arranged to instruct the monitoring means (14,16,18,20) to monitor a set of signals, each signal being distinctive of one of a corresponding set of candidate base stations, the composition of the set of candidate base stations being defined in accordance with the identity of the serving base station.

7. A system as claimed in claim 6, in which each signal in the set of signals distinguishes a respective base station by the frequency of the signal.

8. A system as claimed in anv of claims 1 to 7, in which the indication producing means (30) include a quality decrement/increment estimator (11,52) which is arranged to determine the rise or fall in the quality, from the calculation of the running average of the indications.

9. A system as claimed in any of claims 1 to 8, including means (68) for storing a set of templates of changes in signal quality and/or rates thereof, the control means (56) being arranged to initiate a handover based at least partially on the recognition of a substantial match between the incoming signal and a template.

10. A handover determination method for a mobile radio network comprising a plurality of cells, each having associated with it a base station for supporting communications with a mobile unit, the method comprising:

monitoring a quality of a signal respectively transmitted between each of a plurality of candidate base stations and the mobile unit; and initiating a handover from a serving base station, supporting communication with the mobile unit, to another base station,

characterised in that an indication of the rate of rise or fall in the said quality is produced; and

the handover initiation is based on the indirections of the rates of rise/fall in the said quality of the signal associated with the plurality of candidate base stations being monitored.

11. A method as claimed in claim 10 in which the monitoring of the said quality and producing the said indication is conducted by the mobile unit, the method further including addressing the serving base station from the mobile unit with an indication of the need for a handover to be initiated.

12. A method as claimed in claim 11 in which the mobile unit addresses the base station with an indication of the level of priority of a handover and/or with an indication of the possibility of a handover, contingent upon preceding results of monitoring the quality of the transmitted signal.

13. A method as claimed in any of claims 10 to 12 in which the monitored signal is processed by the mobile unit.

14. A method as claimed in any of claims 10 to 13 in which the monitored quality is the received signal power or the bit error ratio.

15. A method as claimed in any of claims 10 to 14, including monitoring a set of signals, each signal being distinctive of one of a corresponding set of candidate base stations, the composition of the set of candidate base stations being defined in accordance with the identity of the serving base station.

16. A method as claimed in claim 15 in which each signal in the set of signals distinguishes a respective base station by the carrier frequency of the signal.

17. A method as claimed in any of claims 10 to 16, including recognising a set of unique template conditions for joining, leaving and/or staying within a microcell based on interpretation of the rise/fall in signal quality, the initiation of a handover being at least partially determined on the basis of a substantial match between an incoming signal and a template.

18. A mobile unit for a mobile radio system, the mobile unit comprising means (50) for receiving a plurality of signals each respectively transmitted by one of a set of candidate base stations; means (14,16,18,20) for monitoring the quality of the signal; and signalling means (50) for transmitting to a serving base station, supporting communication with the mobile unit, a signal indicating the need for a handover to a candidate base station;

characterised in that the mobile unit includes means (62) for producing an indication of the rise or fall in the said quality of the signals associated with the plurality of candidate base stations being monitored.

19. A mobile unit as claimed in claim 18 in which the signalling means (50) are arranged to address the base station with an indication of the level of priority of a handover and/or with an indication of the level of priority of a handover contingent upon preceding results of monitoring the quality of the transmitted signal.

20. A mobile unit as claimed in claim 18 or 19 in which the monitoring means (14, 16, 18, 20) are arranged to monitor received signal power or bit error ratio.

21. A mobile unit as claimed in any of claims 18 to 20 in which the indication producing means (62) include a quality increment/decrement estimator which is arranged to determine the rise/fall in the quality from the calculation of a running average of the indications.

22. A mobile unit as claimed in anv of claims 18 to 21 including means (68) storing a set of templates of changes in signal quality and/or rates thereof, the signalling means (50) being at least partially responsive to a substantial match of a template with an incoming signal for transmitting to the serving base station the indication of the need for a handover.

Patentansprüche

1. Weiterreichungsbestimmungssystem für ein Mobilfunknetz mit mehreren Zellen, wovon jeder eine Basisstation für die Unterstützung des Informationsaustauschs mit einer Mobileinheit zugeordnet ist, wobei das System enthält:

   eine Überwachungseinrichtung (14, 16, 18, 20) zum Überwachen der Qualität der Signale, die zwischen jeder von mehreren in Frage kommenden Basisstationen und der Mobileinheit übertragen werden;
   eine Steuereinrichtung (56), die die Weiterreichung von einer den Informationsaustausch mit der Mobileinheit unterstützenden Dienst-Basisstation an eine weitere Basisstation beginnt,

   dadurch gekennzeichnet, daß das System eine Angabeeinrichtung (30) zum Erzeugen einer Angabe der Anstiegs- oder Abfallgeschwindigkeit der von der Überwachungseinrichtung (14, 16, 18, 20) überwachten Qualität enthält; und die Steuereinrichtung (56) so beschaffen ist, daß sie eine Weiterreichung als Antwort auf die von der Angabeeinrichtung (30) erzeugten Angaben beginnt, wobei die Angabe auf den Anstiegs-/Abfallgeschwindigkeiten der Qualität der Signale, die den mehreren in Frage kommenden überwachten Basisstationen zugeordnet sind, basiert.

2. System nach Anspruch 1, in dem die Mobileinheit die Überwachungseinrichtung (14, 16, 18, 20) und die Angabeeinrichtung (30) enthält und ferner eine Zeichengabeeinrichtung (50) enthält, die an die Dienst-Basisstation einen Hinweis schickt, daß der Beginn einer Weiterreichung erforderlich ist.

3. System nach Anspruch 2, in dem die Zeichengabeeinrichtungen (50) so beschaffen sind, daß sie an die Dienst-Basisstation eine Angabe des Prioritätsniveaus einer Weiterreichung und/oder eine Angabe bezüglich der Möglichkeit einer Weiterreichung, die aufgrund der vorhergehenden Ergebnisse der Überwachung der Qualität des gesendeten Signals unvorhersehbar ist, schicken.

4. System nach irgendeinem der Ansprüche 1 bis 3, in dem die Zeichengabeeinrichtung (50) die überwachte Qualität des Signals von jeder Mobileinheit an die Dienst-Basisstation senden.

5. System nach irgendeinem der Ansprüche 1 bis 4, in dem die Überwachungseinrichtungen (14, 16, 18, 20) die empfangene Signalleistung oder das Bitfehlerverhältnis überwachen.

6. System nach irgendeinem der Ansprüche 1 bis 5, in dem die Steuereinrichtungen (56) so beschaffen sind, daß sie der Überwachungseinrichtung (14, 16, 18, 20) befehlen, eine Gruppe von Signalen zu überwachen, wobei jedes Signal für eine Station einer entsprechenden Gruppe von in Frage kommenden Basisstationen charakteristisch ist, wobei die Zusammensetzung der Gruppe von in Frage kommenden Basisstationen entsprechend der Identität der Dienst-Basisstation definiert wird.

7. System nach Anspruch 6, in dem jedes Signal in der Gruppe von Signalen eine entsprechende Basisstation durch die Frequenz des Signals charakterisiert.

8. System nach irgendeinem der Ansprüche 1 bis 7, in dem die Angabeerzeugungseinrichtungen (30) eine Qualitätsabnahme/Qualitätszunahme-Schätzeinrichtung (11, 52) enthalten, die so beschaffen ist, daß sie den Anstieg oder den Abfall der Qualität anhand der Berechnung des laufenden Durchschnitts der Angaben bestimmt.

9. System nach irgendeinem der Ansprüche 1 bis 8, mit einer Einrichtung (68) zum Speichern einer Gruppe von Schablonen der Signalqualitätsveränderungen und/oder der Veränderungsgeschwindigkeiten hiervon, wobei die Steuereinrichtung (56) so beschaffen ist, daß sie eine Weiterreichung wenigstens zum Teil auf der Grundlage der Erkennung einer wesentlichen Übereinstimmung zwischen dem ankommenden Signal und einer Schablone beginnt.

10. Weiterreichungsbestimmungsverfahren für ein Mobilfunknetz mit mehreren Zellen, wovon jeder eine Basisstation für die Unterstützung des Informationsaustauschs mit einer Mobileinheit zugeordnet ist, wobei das Verfahren enthält:

    Überwachen der Qualität eines Signals, das

zwischen jeder von mehreren in Frage kommenden Basisstationen und der Mobileinheit übertragen wird; und Beginnen einer Weiterreichung von einer den Informationsaustausch mit der Mobileinheit unterstützenden Dienst-Basisstation an eine weitere Station,

dadurch gekennzeichnet, daß eine Angabe der Anstiegs- oder Abfallgeschwindigkeit der Qualität erzeugt wird; und

der Weiterreichungsbeginn auf den Angaben der Anstiegs-/Abfallgeschwindigkeiten der Qualität des Signals, das den mehreren in Frage kommenden überwachten Basisstationen zugeordnet ist, basiert.

11. Verfahren nach Anspruch 10, bei dem die Überwachung der Qualität und die Erzeugung der Angabe von der Mobileinheit ausgeführt wird, wobei das Verfahren ferner das Schicken einer Angabe, daß der Beginn einer Weiterreichung erforderlich ist, von der Mobileinheit an die Dienst-Basisstation enthält.

12. Verfahren nach Anspruch 11, bei dem die Mobileinheit an die Basisstation eine Angabe des Prioritätsniveaus einer Weiterreichung und/oder eine Angabe der Möglichkeit einer Weiterreichung, die aufgrund der vorhergehenden Ergebnisse der Überwachung der Qualität des gesendeten Signals unvorhersehbar ist, schickt.

13. Verfahren nach irgendeinem der Ansprüche 10 bis 12, bei dem das überwachte Signal durch die Mobileinheit verarbeitet wird.

14. Verfahren nach irgendeinem der Ansprüche 10 bis 13, bei dem die überwachte Qualität die empfangene Signalleistung oder das Bitfehlerverhältnis ist.

15. Verfahren nach irgendeinem der Ansprüche 10 bis 14, enthaltend das Überwachen einer Gruppe von Signalen, wovon jedes für eine Station einer entsprechenden Gruppe von in Frage kommenden Basisstationen charakteristisch ist, wobei die Zusammensetzung der Gruppe der in Frage kommenden Stationen entsprechend der Identität der Dienst-Basisstation definiert ist.

16. Verfahren nach Anspruch 15, bei dem jedes Signal in der Gruppe von Signalen eine entsprechende Basisstation durch die Trägerfrequenz des Signals charakterisiert.

17. Verfahren nach irgendeinem der Ansprüche 10 bis 16, enthaltend das Erkennen einer Gruppe von eindeutigen Schablonenbedingungen für den Eintritt in eine Mikrozelle, zum Verlassen der Mikrozelle und/oder zum Verbleiben in der Mikrozelle auf der Grundlage der Interpretation des Anstiegs/Abfalls der Signalqualität, wobei der Beginn einer Weiterreichung wenigstens zum Teil auf der Grundlage einer wesentlichen Übereinstimmung zwischen einem ankommenden Signal und einer Schablone bestimmt wird.

18. Mobileinheit für ein Mobilfunksystem, mit einer Einrichtung (50) zum Empfangen mehrerer Signale, die jeweils von einer Station einer Gruppe von in Frage kommenden Basisstationen übertragen werden; einer Einrichtung (14, 16, 18, 20) zum Überwachen der Qualität des Signals; sowie einer Zeichengabeeinrichtung (50) zum Senden eines Signals, das den Bedarf an einer Weiterreichung an eine in Frage kommende Basisstation angibt, an eine den Informationsaustausch mit der Mobileinheit unterstützende Dienst-Basisstation;

dadurch gekennzeichnet, daß die Mobileinheit eine Einrichtung (62) zum Erzeugen einer Angabe des Anstiegs oder des Abfalls der Qualität der Signale, die den mehreren in Frage kommenden überwachten Basisstationen zugeordnet sind, enthält.

19. Mobileinheit nach Anspruch 18, in der die Zeichengabeeinrichtungen (50) so beschaffen sind, daß sie an die Basisstation eine Angabe des Prioritätsniveaus einer Weiterreichung und/oder eine Angabe des Prioritätsniveaus einer Weiterreichung, die aufgrund der vorhergehenden Ergebnisse der Überwachung der Qualität des gesendeten Signals unvorhersehbar ist, schicken.

20. Mobileinheit nach Anspruch 18 oder 19, in der die Überwachungseinrichtungen (14, 16, 18, 20) so beschaffen sind, daß sie die empfangene Signalleistung oder das Bitfehlerverhältnis überwachen.

21. Mobileinheit nach irgendeinem der Ansprüche 18 bis 20, in der die Angabeerzeugungseinrichtungen (62) eine Qualitätszunahme/Qualitätsabnahme-Schätzeinrichtung enthalten, die so beschaffen ist, daß sie den Anstieg/Abfall der Qualität anhand der Berechnung des laufenden Durchschnitts der Angaben bestimmt.

22. Mobileinheit nach irgendeinem der Ansprüche 18 bis 21, mit einer Einrichtung (68) zum Speichern einer Gruppe von Schablonen von Signalqualitätsveränderungen und/oder von Änderungsgeschwindigkeiten hiervon, wobei die Zeichengabeeinrichtung (50) wenigstens zum Teil auf eine wesentliche Übereinstimmung einer Schablone mit einem ankommenden Signal anspricht, um an die Dienst-Basisstation die Angabe des Bedarfs an einer Weiterreichung zu senden.

Revendications

1. Système de détermination de commutation destiné à un réseau radio mobile comprenant une pluralité de cellules, chacune ayant une station de base qui lui est associée afin de supporter des communications avec une unité mobile, le système comprenant :

   un moyen de surveillance (14, 16, 18, 20) destiné à surveiller une qualité des signaux respectivement transmis entre chaque station d'une pluralité de stations de base candidates et l'unité mobile,
   un moyen de commande (56) destiné à lancer une commutation depuis une station de base desservante supportant des communications avec l'unité mobile, vers une autre station de base,

   caractérisé en ce que le système comprend un moyen d'indication (30) destiné à produire une indication de la cadence d'augmentation ou de chute de la qualité surveillée par le moyen de surveillance (14, 16, 18, 20), et le moyen de commande (56) est agencé pour lancer une commutation en réponse aux indications produites par ledit moyen d'indication (30) l'indication étant basée sur les cadences d'augmentation/chute de ladite qualité des signaux associés à la pluralité des stations de base candidates qui sont surveillées.

2. Système selon la revendication 1, dans lequel l'unité mobile comprend le moyen de surveillance (14, 16, 18, 20) et le moyen d'indication (30), l'unité mobile comprenant en outre un moyen de signalisation (50) destiné à accéder à la station de base desservante avec une indication du besoin de lancer une commutation.

3. Système selon la revendication 2, dans lequel le moyen de signalisation (50) est agencé pour accéder à la station de base desservante avec une indication du niveau de priorité d'une commutation et/ou avec une indication de la possibilité d'une commutation conditionnelle d'après le résultat précédent de la surveillance de la qualité du signal transmis.

4. Système selon l'une quelconque des revendications 1 à 3, dans lequel le moyen de signalisation (50) transmet la qualité surveillée du signal provenant de chaque unité mobile vers la station de base desservante.

5. Système selon l'une quelconque des revendications 1 à 4, dans lequel le moyen de surveillance (14, 16, 18, 20) surveille la puissance du signal reçu ou le taux d'erreur de bit.

6. Système selon l'une quelconque des revendications 1 à 5, dans lequel le moyen de commande (56) est agencé de façon à ordonner au moyen de surveillance (14, 16, 18, 20) de surveiller un ensemble de signaux, chaque signal étant distinctif d'une station parmi un ensemble correspondant de stations de base candidates, la composition de l'ensemble de stations de base candidates étant définie conformément à l'identité de la station de base desservante.

7. Système selon la revendication 6, dans lequel chaque signal de l'ensemble de signaux distingue une station de base respective grâce à la fréquence du signal.

8. Système selon l'une quelconque des revendications 1 à 7, dans lequel le moyen de production d'indication (30) comprend un estimateur de décrémentation/incrémentation de qualité (11, 52) qui est agencé de façon à déterminer l'augmentation ou la chute de la qualité d'après le calcul de la moyenne mobile des indications.

9. Système selon l'une quelconque des revendications 1 à 8, comprenant un moyen (68) destiné à mémoriser un ensemble de modèles de variations de qualité du signal et/ou de cadence de celles-ci, le moyen de commande (56) étant agencé pour lancer une commutation en se basant au moins partiellement sur la reconnaissance d'une correspondance substantielle entre le signal entrant et un modèle.

10. Procédé de détermination de commutation destiné à un réseau radio mobile comprenant une pluralité de cellules, chacune comportant une station de base qui lui est associée afin de supporter des communications avec une unité mobile, le procédé comprenant :

    la surveillance d'une qualité d'un signal respectivement transmis entre chaque station d'une pluralité de stations de base candidates et l'unité mobile,
    et le lancement d'une commutation depuis une station de base desservante supportant des communications avec l'unité mobile, vers une autre station de base,

    caractérisé en ce qu'une indication de la cadence d'augmentation ou de chute de ladite qualité est produite, et
    le lancement d'une commutation est basé sur les différences de tendances d'augmentation/chute de ladite qualité du signal associée à la pluralité des

stations de base candidates qui sont surveillées.

11. Procédé selon la revendication 10, dans lequel la surveillance de ladite qualité et la production de la ladite indication est conduite par l'unité mobile, le procédé comprenant en outre l'accès à la station de base desservante depuis l'unité mobile avec une indication du besoin du lancement d'une commutation.

12. Procédé selon la revendication 11, dans lequel l'unité mobile accède à la station de base avec une indication du niveau de priorité d'une commutation et/ou avec une indication de la possibilité d'une commutation, de façon conditionnelle suivant les résultats précédents de la surveillance de la qualité du signal transmis.

13. Procédé selon l'une quelconque des revendications 10 à 12, dans lequel le signal surveillé est traité par l'unité mobile.

14. Procédé selon l'une quelconque des revendications 10 à 13, dans lequel la qualité surveillée est la puissance du signal reçu ou le taux d'erreur de bit.

15. Procédé selon l'une quelconque des revendications 10 à 14, comprenant la surveillance d'un ensemble de signaux, chaque signal étant distinctif pour une station parmi un ensemble correspondant de stations de base candidates, la composition de l'ensemble de stations de base candidates étant définie conformément à l'identité de la station de base desservante.

16. Procédé selon la revendication 15, dans lequel chaque signal de l'ensemble de signaux distingue une station de base respective grâce à la fréquence porteuse du signal.

17. Procédé selon l'une quelconque des revendications 10 à 16, comprenant la reconnaissance d'un ensemble de conditions d'un modèle unique pour rejoindre, quitter et/ou rester à l'intérieur d'une microcellule sur la base d'une interprétation de l'augmentation/chute de la qualité du signal, le lancement d'une commutation étant au moins partiellement déterminé sur la base d'une correspondance substantielle entre un signal entrant et un modèle.

18. Unité mobile destinée à un système radio mobile, l'unité mobile comprenant un moyen (50) destiné à recevoir une pluralité de signaux, chacun étant respectivement transmis par une station parmi un ensemble de stations de base candidates, un moyen (14, 16, 18, 20) destiné à surveiller la qualité du signal, et un moyen de signalisation (50) destiné à transmettre vers une station de base desservante, supportant une communication avec l'unité mobile, un signal indiquant le besoin d'une commutation vers une station de base candidate,

caractérisée en ce que l'unité mobile comprend un moyen (62) destiné à produire une indication de l'augmentation ou de la chute de ladite qualité des signaux associés à la pluralité des stations de base candidates qui sont surveillées.

19. Unité mobile selon la revendication 18, dans laquelle le moyen de signalisation (50) est agencé pour accéder à la station de base avec une indication du niveau de priorité d'une commutation et/ou avec une indication du niveau de priorité d'une commutation qui est conditionnelle d'après le résultat précédent de la surveillance de la qualité du signal transmis.

20. Unité mobile selon la revendication 18 ou 19, dans laquelle le moyen de surveillance (14, 16, 18, 20) est agencé pour surveiller la puissance du signal reçu ou le taux d'erreur de bit.

21. Unité mobile selon l'une quelconque des revendications 18 à 20, dans laquelle le moyen de production d'indication (62) comprend un estimateur d'incrémentation/décrémentation de qualité qui est agencé pour déterminer l'augmentation/chute de la qualité d'après le calcul d'une moyenne mobile des indications.

22. Unité mobile selon l'une quelconque des revendications 18 à 21, comprenant un moyen (68) mémorisant un ensemble de modèles de variations de la qualité du signal et/ou des vitesses de celles-ci, le moyen de signalisation (50) répondant au moins partiellement à une correspondance substantielle d'un modèle avec un signal entrant afin de transmettre à la station de base desservante l'indication du besoin d'une commutation.

Fig. 1.

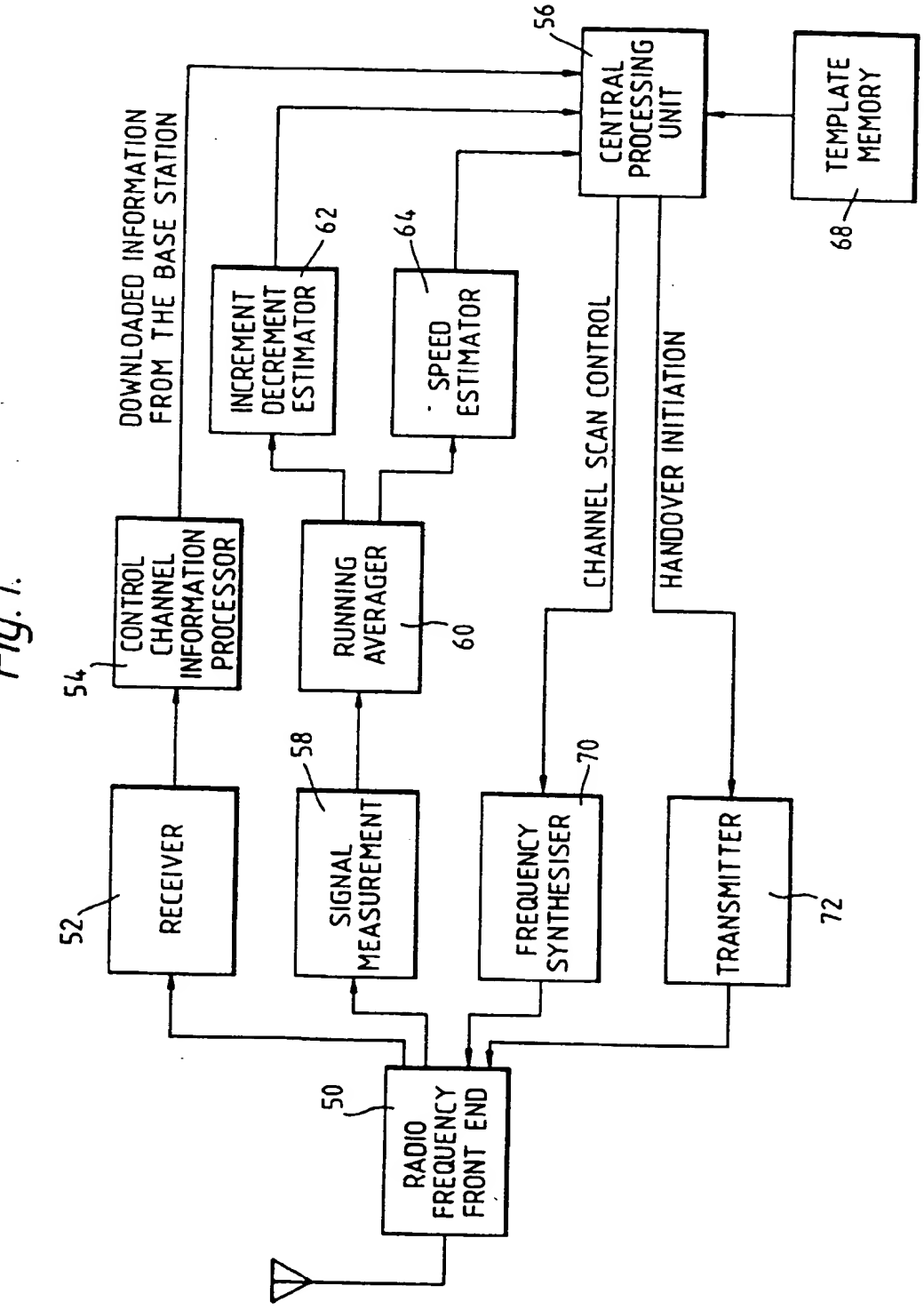
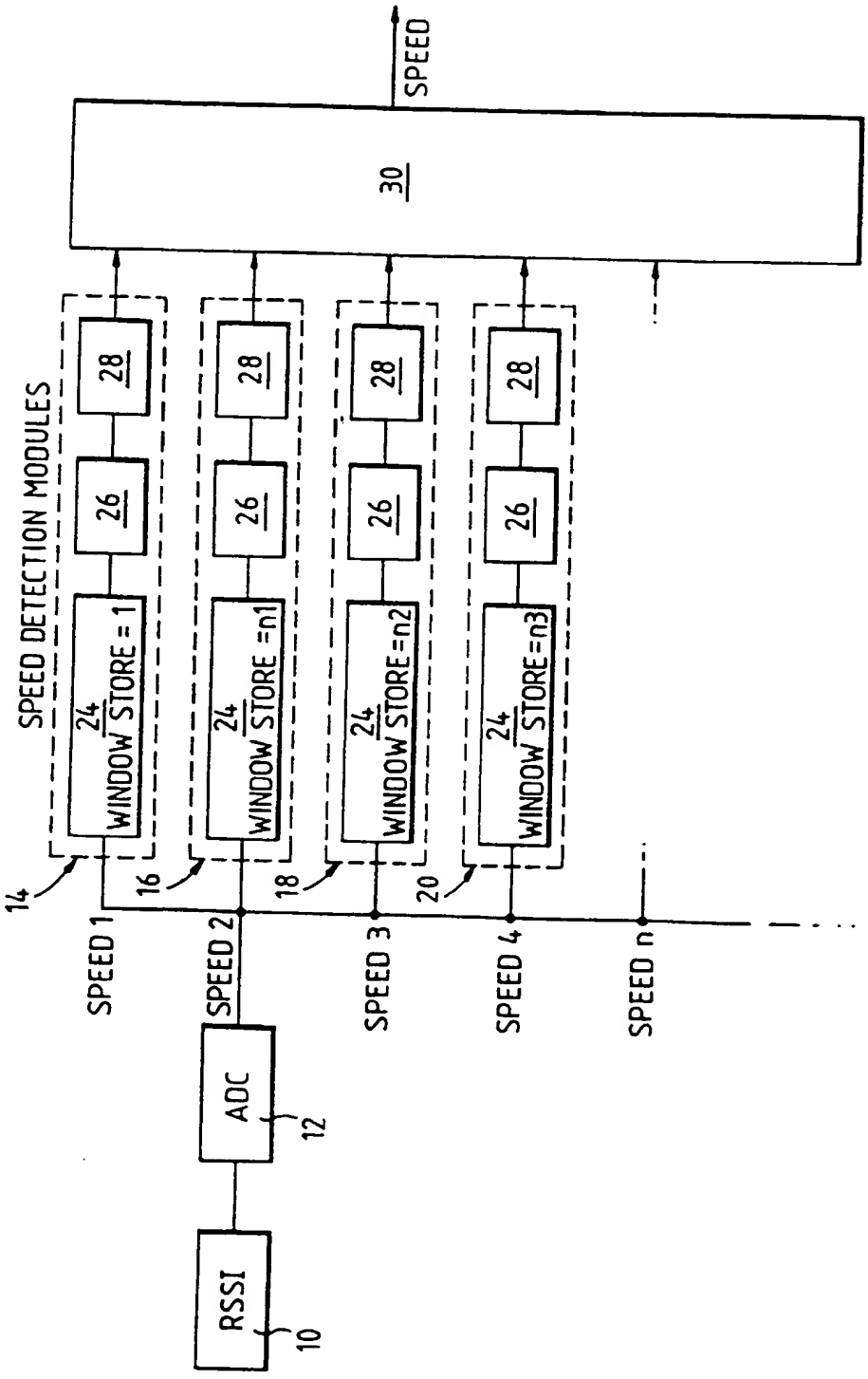

RADIO FREQUENCY FRONT END
50
RECEIVER
52
CONTROL CHANNEL INFORMATION PROCESSOR
54
SIGNAL MEASUREMENT
58
RUNNING AVERAGER
60
INCREMENT DECREMENT ESTIMATOR
62
SPEED ESTIMATOR
64
CENTRAL PROCESSING UNIT
56
TEMPLATE MEMORY
68
FREQUENCY SYNTHESISER
70
TRANSMITTER
72
DOWNLOADED INFORMATION FROM THE BASE STATION
CHANNEL SCAN CONTROL
HANDOVER INITIATION

Fig. 2.


SPEED
30
SPEED DETECTION MODULES
28
26
24
WINDOW STORE = 1
WINDOW STORE =n1
WINDOW STORE =n2
WINDOW STORE =n3
14
16
18
20
SPEED 1
SPEED 2
SPEED 3
SPEED 4
SPEED n
ADC
12
RSSI
10